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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/982,953	10/22/2001	Allen McTeer	M4065.0247/P247-A	8778

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EXAMINER
KENNEDY, JENNIFER M

ART UNIT	PAPER NUMBER
2812	

DATE MAILED: 05/09/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/982,953	MCTEER, ALLEN	
	Examiner	Art Unit	
	Jennifer M. Kennedy	2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 March 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *22-35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *22-35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Response to Amendment

Applicant's arguments with regard to the rejections under 35 U.S.C. 102 or 103 have been fully considered, but they are not deemed to be persuasive for at least the following reasons.

Applicant's argument concerns that Moslehi teaches a free-space ILD/IMD structure that eliminates the need for the use of diffusion barrier layer at each interconnect level, and thus the copper can be deposited directly on the patterned structure without the need for the diffusion barrier layer. The examiner respectfully points out that the Moslehi reference was used for the teaching of the top passivation layer of AlN. Moslehi was not used for the teaching of barrier layers between the interconnect levels.

The applicant also argues that the passivation layer of Moslehi hermetically seals the interconnect structure and comprises three layers. The examiner notes that the claim language "comprising" does not preclude additional layers or steps. Further the examiner notes that the AlN layer is clearly referred to as a passivation layer and the fact that performs additional functions such as a sealing layer is not relevant.

The applicant also argues that the AlN layer is not a heat radiating layer. Moslehi clearly discloses the layer is highly thermal conductive, and the examiner points out that the material is the same of that of the applicants "heat-radiating layer", namely AlN. Finally, it is the presence of the passivation layer, including AlN that allows for a

hermetic seal which results in the helium-filled free-space intermetal/interlevel dielectric medium which provides excellent heat transfer (heat radiation) (see column 15, lines 5-20). Thus, it is the helium filled free space and passivation layer (including the AlN layer) that can be considered the heat-radiating layer.

Furthermore, applicant argues that the cited references are directed to solving different problems. The fact that the two references are teaching inventions that solve two different problems does not mean that the references are not combinable. Moslehi and Chiang et al. are analogous art, teach in combination every limitation claimed and the examiner has provided a motivation for combining the two references in the non-final office action sent 12/13/2002 as Paper No. 5.

Finally, the applicant argues that Moslehi are only directed to multi-level interconnect structures. The examiner points out that Chiang et al. is also a multi-level interconnect structure. Further, the examiner notes that the applicant also describes in the specification a multi-level interconnect (see Figure 12). Finally, it is noted that the feature upon which the applicant relies (single-level interconnect) is not recited in the rejected claims. Although the claims are interpreted in light of the specification, limitations form the specification are not read in to the claims . *In re Van Guens*, 988 F.2d 1181, 26 USPQ2d 1057.

The rejection is set forth below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 22-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al. (U.S. Patent No. 5,739,579) in view of Moslehi et al. (U.S. Patent No. 6,016,000).

Chiang et al. disclose the method of forming a copper interconnect structure providing electrical connection to a substrate, comprising the steps of;

forming a first contact opening into a first insulating layer (391) of the substrate (320);

forming a conductive plug in the first contact opening (394);

forming a second insulating layer (395) over the conductive plug and said first insulating layer;

forming a second contact opening in the second insulating layer;

forming a barrier layer (396) in the second contact opening;

forming a copper conductor (397) over the barrier layer; and

forming a passivation layer on an upper surface portion of the copper conductor, the passivation layer being a continuous layer, (see column 20, lines 24-33, the method explained in detail with reference to the lower interconnect layer).

Chiang et al. also disclose the method of CMP the copper layer and the barrier layer (see column 20, lines 1-3), and wherein the barrier layer is formed of a refractory metal compound being selected form the group consisting of refractory metal nitrides, refractory metal carbides, and refractory metal borides (see column 19, lines 4-10).

Chiang et al. does not disclose the method of forming the heat-radiating passivation layer of aluminum nitride by sputtering, or the method of cleaning the upper surface portion of the copper conductor prior to the formation of the aluminum nitride layer.

Moslehi discloses the method of forming the heat radiating passivation layer of aluminum nitride by sputtering (see column 14, lines 16-60 and column 15, lines 1-24), or the method of cleaning the upper surface portion of the copper conductor prior to the formation of the aluminum nitride layer (see column 12, lines 32-35). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the passivation layer of aluminum nitride as Moslehi teaches in order to form a passivation layer that has the advantage of high thermal conductivity. Further, it would have been obvious to one of ordinary skill in the art at the time the invention was made to clean the surface of the copper prior to the formation of the passivation layer in order to remove contaminants from the surface.

Moslehi also discloses the method wherein the aluminum nitride is a thickness of approximately 300 angstroms (see column 14, lines 20-23). Further, the selection of the thickness is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162

USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Kennedy whose telephone number is (703) 308-6171. The examiner can normally be reached on Mon.-Fri. 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on (703) 308-3325. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7724 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

jmk
May 7, 2003

John F. Niebling
Supervisory Patent Examiner
Technology Center 2800